

Module 1 – Ratios, Rates and Percentages

Overall, we found this module to be aligned well for RP.A.1 and RP.A.2.

¹Required Vocabulary/Stimulus for Students:

Vocabulary: Ratio, unit rate, unit price, ordered pair, percentage

Stimulus: tape diagram, double-number line, coordinate planes, tables

7th grade vocabulary that appears in this module:
constant (grade 7 introduces the constant of proportionality)

²Teacher Background/Summary of Findings

The work in this module builds (and sometimes includes) the foundations for the proportional reasoning work of grade 7 and 8. Students begin by graphing proportional relationships in grade 6 which leads to them being able to determine if a relationship is proportional at grade 7 (points are in a straight line and the line goes through the origin on the graph). In grade 7 students distinguish between a relationship that is proportional vs one that is linear but not proportional.

It should be noted that this module does **NOT** contain lessons involving the **cross-product algorithm**. This algorithm does not assist in the development of proportional thinking and was intentionally left for later grades. Grade 6 lays the conceptual foundation of proportional reasoning.

In lesson 13, the work of expressions/equations (module 4) is begun in writing equations from tables. It is further developed in module 4 when students begin writing equations to represent the relationships between dependent and independent variables.

¹ Eureka section on vocabulary sometimes includes vocabulary not in the CCSS – We included essential CCSS vocabulary on each of our summaries for this reason.

² We felt teachers needed additional information at grade 6 to understand how to help prepare students for grades 7 and 8.



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Students do some great work in Topic D to solve percent problems. However, this is where we found the materials to be lacking enough lessons/practice to get students to standard. Particularly, we do not see any place in the module where students develop an understanding of how to calculate a percent with decimals. We have not seen how this particular item type from Smarter Balanced is supported in the materials:

Example Stem 1: In a school with 200 students, 45% are males.

Select **all** expressions that can be used to find the total number of male students.

A. $\frac{45}{100} \bullet 200$

B. $\frac{0.45}{100} \bullet 200$

C. $0.45 \bullet 200$

D. $\frac{45}{10} \bullet 200$

Example Stem 2: Select **all** expressions that can be used to find 45% of 200.

A. $\frac{45}{100} \bullet 200$

B. $\frac{0.45}{100} \bullet 200$

C. $0.45 \bullet 200$

D. $\frac{45}{10} \bullet 200$

In addition – these item types were also difficult for students given the number of lessons.

Enter the unknown value that makes this statement true:

30% of is 60.

Example Stem 2: Enter the unknown value that makes this statement true:

45 is % of 50.



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We suggest including problems as openers that reflect various methods to solve these problems in addition to tape diagrams, ratio tables and double-number lines supported in this module over the course of the year. A separate document with optional problems will also be uploaded to the Eureka/Engage UserGroup site.

We would suggest re-enforcing problems with multiplying by a decimal in module 2. Students could also gain experience with solving these problems with equations in module 4 and work with equivalent expressions.

Additional Resources:

Illustrative Mathematics

Additional tasks to support the module

<https://www.illustrativemathematics.org/6.RP>

Massachusetts Department of Elementary and Secondary Education

OER Replacement Unit. This would not be a replacement for this module but could provide supplementary problems in the percentage component for additional practice. Simple registration is required to access the materials.

http://www.doe.mass.edu/candi/model/download_form.aspx

Achieve the Core

Quality mini-assessment on ratios and rates.

<http://achievethecore.org/page/1051/ratios-and-rates-mini-assessment>



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Module 2 – Number System

Required Vocabulary/Stimulus for Students:

Vocabulary: Fraction, sum, difference, quotient, product, common factor, greatest common factor, common multiple, least common multiple, distributive property

Stimulus: visual fraction models

Teacher Background/Summary of Findings:

Division of Fractions:

The module we evaluated was the latest update from Eureka. We were very pleased to see the revisions to this module to align with grade 5 models for division of fractions. This will help to connect to the work of the previous grade. It is important to develop this concept fully before rushing to an “invert and multiply” rule. This occurs in lesson 7, but we suggest holding off if students cannot explain the reason for this.

Teachers may want to access this Illustrative Mathematics task for support:

<https://www.illustrativemathematics.org/content-standards/6/NS/A/tasks/2166>

Computing with multi-digit numbers and finding common factors and multiples:

In grade 6, students are to master the standard division algorithm. Currently, there are only three lessons focused on this with only one on whole number division. While students are generally introduced to this algorithm in lower grades, mastery is not expected until grade 6. It seems odd that the numbers used for this first lesson are so large. It is not necessary to begin with a 5 digit by 2-digit division problem. Test and item specifications for Smarter Balanced do indicate that students could be asked UP TO a 6 digit number divided by a 2-6 digit number; however, there are a range of problems within this to begin with (4-6 digit dividend with 2-6 digit divisor).

For sixth grade teachers who are not familiar with the place value models used in grades 4 and 5 with division, we strongly recommend teachers read the work done in lower grades. This can help teachers to see how to connect the models and place value language to the standard algorithm. These models are very valuable for students struggling to make the connections to the standard algorithm and can be useful strategies for differentiation.

It states in the teacher’s instructions that, “They (the students) became efficient in applying the standard algorithm for long division.” While it is true that the standard algorithm has been introduced and developed in earlier grades in Eureka, it was NOT a mastery standard. This means that teachers did NOT necessarily get most students to use this algorithm efficiently and this fluency may take more time to develop.

We have seen many teachers get “stuck” in this module due to the large size of the



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numbers and the length of time to get students to mastery. Because topics B, C, and D are not major focus standards of grade 6, we do not recommend spending much more time here than allotted (**division of fractions IS major work**). Instead, look to revisit these concepts in later modules – particularly modules 4 and 5. Feel free to cross out **all** problems with 7 digit dividends!

An area where module 1 is weak is in providing enough lessons for students to see different ways to compute percent of a number. Because they are working on fluency in multiplication and division of decimals, this would be an appropriate time to introduce finding percents through multiplication of decimals and increasing fluency with relationships between fraction, decimal and percent representations. This would also be an appropriate time to connect finding a percent with a fractional representation. For example: If a student achieved $\frac{6}{8}$ on a quiz – what percent did they answer correctly? This question builds on the work of grade 5 where students understand that a fraction can be written as a division equation and divide decimal fractions.

This represents a task model from the SBA that we do not feel is adequately taught to:

Example Stem 1: In a school with 200 students, 45% are males.

Select **all** expressions that can be used to find the total number of male students.

- A. $\frac{45}{100} \bullet 200$
- B. $\frac{0.45}{100} \bullet 200$
- C. $0.45 \bullet 200$
- D. $\frac{45}{10} \bullet 200$

Example Stem 2: Select **all** expressions that can be used to find 45% of 200.

- A. $\frac{45}{100} \bullet 200$
- B. $\frac{0.45}{100} \bullet 200$
- C. $0.45 \bullet 200$
- D. $\frac{45}{10} \bullet 200$



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Several lessons in the last topic are not connected directly to CCSS. The number theory lessons 16 and 17 are not related to standards. These skills can be valuable tools in working with division, but include at your discretion.

This is also true for the last lesson in this module (19). It is an extension of finding the GCF and is not required by the CCSS. This would be better served as an extension for students who have mastered this unit's standards in order to provide time for small group work for students struggling with these concepts.

Additional Resources:

MARS Assessment Task

Performance task incorporating standards from module 1 and 2.

<http://www.insidemathematics.org/assets/common-core-math-tasks/sewing.pdf>

Decimal Operations Maze Game

Activity to deepen understanding of decimal operations

[https://illuminations.nctm.org/uploadedFiles/Content/Lessons/Resources/6-8/BigSmall-AS-Maze\(1\).pdf](https://illuminations.nctm.org/uploadedFiles/Content/Lessons/Resources/6-8/BigSmall-AS-Maze(1).pdf)

OSPI Assessment webpage.

This page contains a link to cluster quizzes. A quiz was developed for 6.NS.A

<http://www.k12.wa.us/Mathematics/Assessment.aspx>

Illustrative Mathematics

Additional tasks to support the module.

<https://www.illustrativemathematics.org/content-standards/6/NS/A>

<https://www.illustrativemathematics.org/content-standards/6/NS/B>



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Module 3 – Summary Document

Required Vocabulary/Stimulus for Students:

Vocabulary: Positive, negative, integer, absolute value, coordinate, ordered pair, coordinate grid/plane, quadrant, number line relative position, magnitude

Stimulus: horizontal and vertical number lines, coordinate planes

Teacher Background/Summary of Findings

Overall, we found this module to be well aligned. The focus at grade 6 for these standards is conceptual development and we find that the heavy use of number lines in this module really works to support this. Students are immersed in the work of understanding integers as a set of numbers and their opposites.

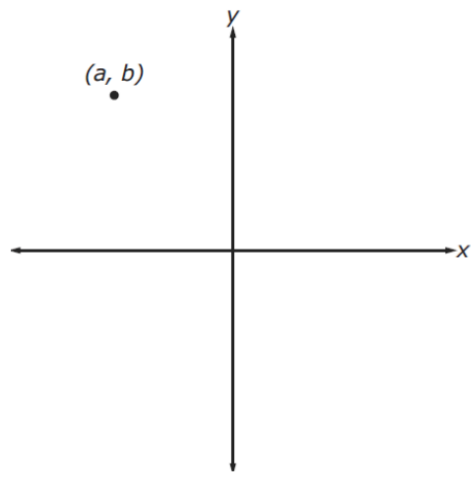
One key idea that we would like to see developed further in this module is the idea that a variable with a negative sign in front of it is seen as the **opposite** of the variable.

This Smarter Balanced item type exemplifies this part of the standard but we do not see it well supported in the module.

TM2c

Stimulus: The student is presented with coordinate axes and a point labeled (a, b) in one of the quadrants.

Example Stem: The point that corresponds to (a, b) is shown in the coordinate plane. Use the Add Point tool to graph $(-a, b)$.



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In the sequence of skills, expressions and equations is the module after this work, but this idea in relationship to variables does not come up in that module.

We have found it difficult to find other OER materials that deal with this standard correctly. This is the standard:

6.NS.C.6 Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.

- a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., $-(-3) = 3$, and that 0 is its own opposite.
- b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.
- c. Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

In particular, we have found that many resources (including Eureka) take part b in this standard to mean that students should learn how to “reflect” points and use this vocabulary with students. This is not the intent as reflections are not a standard until grade 8. Lesson 16 uses language that does not align to the standards in this way. The emphasis should be on extending student’s understanding of numbers and their opposites from placement on the number line to their placement on the coordinate plane rather than simply identifying which quadrant a point falls in or using reflection language.

Additional Resources

Deflategate on YummyMath

Math task exploring integers on a number line (Solution requires a paid subscription)
<http://www.yummymath.com/2015/deflategate/>

Greg Tang Math

Minus Math (levels 1 and 2 for grade 6)

Math game for plotting integers on number lines and coordinate grids.
<http://gregtangmath.com/games>

PBS Learning Media

Interactive lesson on opposites of numbers from Math at the Core Middle School Collection
<http://d3tt741pwxqwm0.cloudfront.net/APT/Opposites/story.swf>



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Module 4 – Expressions & Equations

Required Vocabulary/Stimulus for Students:

Vocabulary: sum, product, quotient, difference, negative, term, factor, coefficient, expression, algebraic expression, numerical expression, order of operations, distributive property, associative property, commutative property, variable, equation, inequality, solution, solution set, dependent variable, independent variable, relation

Stimulus: graphs, tables

Teacher Background/Summary of Findings:

We felt this module required the most adjustments/modifications of all the modules in the grade 6 program. For this reason, our recommendations are broken down by topics and lessons. In grade 6, much of the major work is building ideas at the conceptual level with fluency developed at grades 7 and 8. This is the case with the work on expressions and equations. Overall, we found limited conceptual development with these concepts. The use of tape diagrams seemed inappropriate in many instances and there is a lack of manipulative use with concepts that are introductory. There are many materials for purchase that support these standards, but because they are not OER we did not include them in this document. We can see the need, however, for more concentrated work in the future on this module.

Topic A: Lessons 1-4:

Work in lessons 1-4 is around understanding the relationships of opposite operations and understanding that a variable represents a specific unknown amount. Tape diagrams are used to model whole number expressions.

We feel this is **not** the best use of the tape diagram. We feel tape diagrams are best used to model **problems** not expressions. Revisiting how to model problems with tape diagrams in this unit (particularly with non-negative **rational** numbers) will help students see how to write equations/expressions from the diagrams to represent/solve the problems in another way. See resources for tape diagrams for additional support.

Suggestions for these lessons:

Rather than tape diagrams - use number line diagrams to relate opposite operations. This builds upon the work in lower grades and links to the previous unit with integers.

Additional Resource for tape diagrams:



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Thinking Blocks

Randomly generated problems for all operations along with ratios and fractions. Problems get progressively more difficult and include lots of problem types.

http://www.thinkingblocks.com/ThinkingBlocks_Ratios/TB_Ratio_Main.html

<http://www.mathplayground.com/thinkingblocks.html>

Additional Resource for building conceptual understanding of expressions/equations:

SolveMe Mobile Puzzles

A great introduction to the unit and one that you can come back to throughout the unit (particular lessons 9-14)

<http://solve.me.edc.org/Mobiles.html>

Topic B: Lesson 5 & 6:

Exponents & Order of Operations

We would suggest adding an area model *visual* in when introducing square numbers in lesson 5 to *show* why we say “8 squared.”

Additional Resource for Order of Operations

Order of Operations – Who wants to be a Millionaire game:

<http://www.math-play.com/Order-of-Operations-Millionaire/order-of-operations-millionaire.html>

Topic C: Lessons 7 & 8

Lesson 7 – Evaluating formulas in real world problems

Lesson 8 – Properties of Operations

Properties of Operations Resources

PBS Video

<http://www.pbslearningmedia.org/resource/mgbh.math.nf.commpop/commutative-and-associative-properties-of-addition/en/>

Topic D: Lessons 9-14: Writing expressions – expanding, distributing with all operations



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Several lessons in this topic (9, 11, 12, 13) again model expressions with tape diagrams.

Suggestion: Use the thinking block website to pull problems for the operations shown. Model these with tape diagrams and **then** represent them with expressions with variables standing for the unknowns and expand to talk about other ways they might see these expressed in words.

Lesson 10 is intense with vocabulary introductions and goes a bit beyond the standards. Critical vocabulary is identified at the beginning of this document.

Lesson 11: Vocabulary does not match exactly with standards at grade 6. Students should be focusing on writing equivalent expressions with the distributive property. The exit ticket requires students to use the greatest common factor to write equivalent expressions in factored form. This is not the standard. Students should be able to use the distributive property to write and recognize many equivalent expressions – not just those that factor out the greatest common factor. Factored form is not grade 6 vocabulary.

Suggestion: Introduce Frayer (see resource below) models for critical new vocabulary terms throughout the unit or have a vocabulary notebook for the unit.

The vocabulary in these lessons is sometimes difficult for students to understand. The correct prompts for many of these lessons would be better as: **writing equivalent expressions**.

We also feel that the **area model** would be a better representation for modeling the distributive property. This model connects to grade 3-5 learning as well as work in grades 7-8. (Lessons 11/12)

There are several good points in the teacher directions to highlight in these lessons like how to think about letters standing for numbers, but this could also be reinforced with a lesson using the interactive mobiles.

Resources for Area Models for the Distributive Property

NCTM Illuminations

<http://illuminations.nctm.org/Lesson.aspx?id=2682>

Topic E: Lessons 15-17: Math vocabulary and reading/writing expressions

Additional Resources for Vocabulary

Virtual Nerd

Video lessons on math vocabulary



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<http://www.virtualnerd.com/common-core/all>

Caution: be sure to watch ahead of time as some videos go beyond the 6th grade standard.

Framer Models for Vocabulary

<https://wvde.state.wv.us/strategybank/FramerModel.html>

Topic F: Lesson 18-22: Writing and Evaluating Expressions and Formulas

Many problems deal with two-step patterns (multiplication then addition). This is fine to introduce but above the standard. Focus on one step patterns to write equations.

Topic G: Lessons 23-29: Solving Equations/Inequalities

This module introduces inclusive inequalities in several places. The standards do not specify the use of inclusive inequality symbols (\geq , \leq) at grade 6 although it makes sense to include this idea in the context of solving problems. The test and item specifications for Smarter Balance also avoid these symbols at grade 6 in claim 1 items. There is discrepancy, however in the achievement level descriptors which include inclusive inequalities. Emphasis should be placed on mastering the use of strict inequalities ($<$, $>$) in both solving and graphing. We checked many sources to try to determine with certainty about whether or not inclusive symbols may be seen in the Smarter Balanced assessment but could find nothing conclusive. Again, they are not included in claim 1 items.

In lessons 28 and 29 students work to model problems with tape diagrams and then write equations from the models. We found some of the tape diagrams to be a bit awkward (not always following from the work in K-5) and the wording for writing the equations to be confusing. We would suggest asking students to come up with many equivalent equations/expressions to represent different aspects of the problems.

Example 1 – lesson 28:

Let students try to model the problem with a tape diagram. Share representations together.

Teacher then asks:

What are some different equations we can write based on the amounts that we don't know? (generating many equivalent equations)

Is there an equation that represents the amount of money Marissa has related to the amount of money Christina has? (working to have students make connections between amounts)

Topic H: Lessons 30-34: Applications on equations, graphing inequalities, and using variables to represent two quantities in relationship to one



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another. Writing equations from graphs representing independent/dependent variables

Lesson 30: Applies equation skills to 4th grade geometry standards. We feel time would be better used by applying to grade 6 geometry standards. This is not bad review – but not worth a day.

In lessons 31 and 32, problems go substantially beyond the 6th grade standards. Focus on the problems dealing with a single multiplication or addition pattern such as example 2 and exercises 1 & 2 in lesson 31.

In lessons 33-34 inclusive inequality symbols (\leq , \geq) are included in the lessons. See comments from lessons 23-29.

Lesson 34 is the only lesson graphing inequalities. This lesson also includes compound inequalities (Example 2: $6 \leq x \leq 20$) which is *not* a grade 6 standard. It also focuses on graphing with the inclusive inequality symbols. This is a lot to do in one day. Focus first on strict inequalities ($<$, $>$).

Suggestions: Rather than move to problems rapidly like #3 in exercise 3 in lesson 31 – Take the time to graph the problems and see connections between the graphs, problems and equations.

Take time in lesson 32 to make the connections between a relationship that is linear and proportional ($20=4x$) to one that is just linear ($20=4x+3$). This is not a mastery concept at grade 6 but very foundational to grade 7 work. Time to get kids to mastery of writing the equations for these graphs (such as $t = 3r + 5$) is **not** necessary (gr7). Just starting to recognize the patterns is helpful.

Graphing Inequalities Resource:

<http://www.pbslearningmedia.org/resource/algebra-inequality-1d-school-yourself-algebra/inequalities/>

Comments on Sprints in this Module

Fluency development

In this module sprints are included in several places to build fluency. We do not recommend doing the sprints associated with division of fractions as a “sprint”



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(6.NS.A.1). Fluency is not the target at grade 6 for this standard – it is conceptual development. **Please do not time students on this skill.**

Additional Resources to Support the Unit as a Whole

Tape Diagrams to model Problems

Thinking Blocks:

http://www.thinkingblocks.com/ThinkingBlocks_Ratios/TB_Ratio_Main.html

<http://www.mathplayground.com/thinkingblocks.html>

Howard County OER Resources:

<https://hcpss.instructure.com/courses/125/pages/unit-3-at-a-glance>

Many free games listed by standard –Including teacher accounts

www.mathgames.com

Additional Assessment Options:

Achieve the Core Mini Assessment – Cluster A

<http://achievethecore.org/page/910/extending-previous-understandings-of-properties-mini-assessment-detail-pg>



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Module 5 – Area, Surface Area and Volume

Required Vocabulary/Stimulus for Students:

Vocabulary: coordinate, ordered pair, coordinate plane, compose/decompose, vertices, right triangle, unit fraction, edge length, area, surface area, volume, nets, faces, edges, vertices

Stimulus: coordinate planes, diagrams representing two- and three- dimensional figures

Teacher Background/Summary of Findings:

We found module 5 to have a good connection to the standards with a logical sequence.

When working with parallelograms and triangles – diagrams have the altitude labeled without any teacher materials/explanation on the relationships between the height and the altitude. Formulas are labeled with an h but do not explain the connection with the vocabulary of altitude in the problem. They use them synonymously.

In our opinion, since altitude is not a vocabulary term at grade 6 in the CCSS we would recommend de-emphasizing its use and just focus on height.

If time is an issue in relationship to testing, we recommend Topic B be placed at the end of the module because it applies skills from an earlier module (module 3). This would give priority for time on content students have not yet been introduced to this year (volume and surface area).

Concepts of volume and surface area could easily be introduced earlier in the year in other modules when students are working with whole numbers and decimals, as volume is now a major cluster at grade 5. Volume problems extend from rectangular prisms with side lengths of whole numbers in grade 5 to non-negative rational numbers in grade 6. This would assist when the formulas for volume are applied in module 4 before unit.



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Additional Resources

Illustrative Mathematics

Additional tasks to support the module.

<https://www.illustrativemathematics.org/content-standards/6/G/A>

Geogebra

This free program provides lots of interactive geometry activities for students to see relationships. Explore GeoGebra Tube (first link) to find the examples that best suit your needs. Additional links show a variety of examples.

<https://www.geogebra.org/search>

<https://www.geogebra.org/b/142909#material/BdhvjmzN>

<https://www.geogebra.org/m/fuqrmxQy?doneurl=%2Fsearch%2Fperform>

<https://www.geogebra.org/m/XPnzEnTA?doneurl=%2Fsearch%2Fperform%2Fsearch%2Fnet%2Bof%2Bsolid%2Bfigures>

A Puzzling Cube – nrichmaths

Fun exploration of the net of a cube

<http://nrich.maths.org/1140>



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Module 6 - Statistics

Required Vocabulary/Stimulus for Students:

Vocabulary: variation (variability), interquartile range, range, mean absolute deviation, center, spread, mean, median, outliers, shape (pertaining to statistics such as gap, cluster, peak, skew, bell curve, and uniform distribution)

Stimulus: dot/line plots, lists of numbers, tables, graphs, or other visual graphics to display a set of numbers, number line diagrams, histograms, box plots

Teacher Background/Summary of Findings:

We found this to be a comprehensive module reflective of the standards. Our biggest concern with this module is the time required to get to it and teach it completely. In these years of transition, we are still working with students who have not come through the system with the Common Core Standards, and we have to modify and build understanding with many students who are assumed to have come with the experiences needed to enter into the lessons.

The work in this module mostly reflects work of additional clusters rather than major or supporting clusters. Because these standards also include many new concepts and vocabulary they are more difficult to integrate into other units.

We recognize that additional clusters do not mean “less important.” For this reason, we recommend trying to integrate some of these concepts into other areas before this module begins. This way students may be able to move in a more compacted way when they get to this module, and if teachers are unable to teach it fully, they will at least have been introduced to many of the concepts and vocabulary represented in the clusters.

Suggestions for early integration:

- Introduce statistical questions at the beginning of the year in “get to know you” activities about the class. Display results of the data in graphs (dot plots, histograms).
- Reinforce different graphical representations in science and social studies
- Introduce the concepts of mean and median in module two as an application of multi-digit division with whole numbers and decimals

Additional Resources



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Illustrative Mathematics

Additional tasks to support the module

<https://www.illustrativemathematics.org/content-standards/6/SP>

nrich

Problems solving tasks with mean

http://nrich.maths.org/public/leg.php?group_id=44&code=213 - results



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